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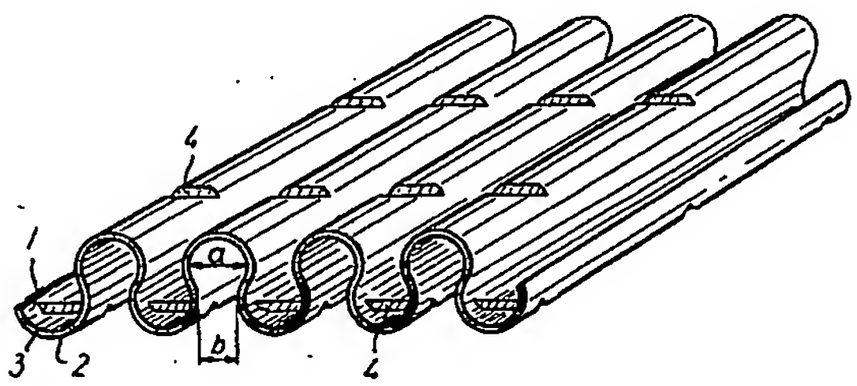
(54) Deformable sheet material, especially for use in roof tightening.

(57) By corrugating a deformable sheet material for use in roof tightening to a continuous S-shape forming waves with troughs, the diameter (a) of which is greater that their slit aperture (b), and by providing the crests of the waves and the external side of the valleys with transverse stampings (4), the sheet can be given substantially the same stretchability and workability as a conventional plane sheet lead and can be used in replacement thereof, for example for tightening the connection between a skylight flashing and a non-plane roofing.

The sheet material may consist wholly of lead or another metal, in which case a sheet of smaller thickness than conventional sheet lead can be used, which gives an improved workability, so that assembling can be carried out without hammering with the resulting variations in thickness.

The sheet material may, alternatively, be carried out in the form of a sandwich consisting of an aluminium foil (1) and a tension reducing and stabilizing protective layer which may comprise an adhesive paste (3) and a cover foil (2) on one side of the foil (1) or layers of elastomeric material such as naturel or synthetic rubber on one side or both sides of the foil.

In the latter embodiment, the sheet material may be given the shape of a strip, in one longitudinal side of which a strip- or thread-shaped plumb may be inserted for the purpose of weighing down the strip.



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Deformable sheet material, especially for use in roof tightening.

For outdoor lead-work on buildings, for instance to provide water- and snowproof tightening between a skylight flashing and a roofing of tiles or corrugated plates, use is made to a large extent of sheet lead about 1 mm thick, on account of the good weatherproofness of the material and of its ductility and very low coefficient of elasticity, which allows shaping of a plane sheet into double curves and which furthermore is easy to cut or clip as required. These qualities are, however, accompanied by economical as well as environmental drawbacks, since, on one hand, lead is a comparatively expensive raw material and is also expensive with respect to transportation costs due to its heavy weight and, on the other hand, it involves a certain risk of poisoning.

For some working operations, instead of sheet lead use can be made of a sandwich material disclosed, for instance, in British patent specification 1 095 393, said sandwich material consisting of a foil of aluminium or thermoplastics and a thicker, pressure adhesive coating of bitumen and a flexible polymeric material compatible therewith as well as a detachable cover layer or protecting paper. This material, however, does not stand being stretched and bent to a double curved shape as required for instance for covering the passage from a plane surface to a curved or corrugated roofing. The known material in question is used primarily as a weatherproof adhesive tape for tightening joints and cracks.

The present invention has for its object mainly to provide a material having improved properties as regards workability not only in comparison with the above-mentioned sandwich material, but also as compared to conventional sheet lead which, when disposed on a corrugated roof plate, must be secured by hammering at

the wave crests, which makes it difficult to control the final sheet thickness and involves a risk of damaging the material and causing cracks or breakage. As compared to the said sandwich material, a further object of the invention is to achieve a tightening which in the same manner as in case of conventional sheet lead does not require a permanent adhesion to the support.

Thus the invention relates to a deformable sheet material especially for use in tightening operations, and of the kind consisting at least partly of sheet metal or a metal foil. According to the invention, this sheet material is characterized in that it is corrugated in continouos S-shaped waves with troughs, the greatest diameter a of which is a little greater than the width b of the corresponding slit aperture.

This special corrugation results in the thin metal sheet being able to stand an extensive, local or variable stretching to double curved shape without local breakage or cracks, as the sides of the troughs or waves may curve more or less and thereby absorb a varying amount of material without any noticeable changes in the appearance of the sheet.

In order to further improve the workability, provision can be made at the crest of the waves of transverse stampings with a mutual separation of the same order of magnitude as the wave length. Such transverse stampings render the waves less rigid in the longitudinal direction and furthermore break the striped pattern of the waves as they modify it into a honeycomb pattern which to a substantial extent blurs local deformations.

The sheet material according to the invention can in general consist of sheet metal, e.g. lead, whereby a substantially thinner sheet may be used than for conventional sheet lead where the thickness must be sufficient to allow the necessary deformation by stretching of the material. Mounting on a corrugated roofing surface can then be carried out solely by

manual processing of the material without hammering and the resulting local variations in thickness with may cause cracks or breakages.

Alternatively, the sheet material according to the invention may consist of a sandwich of metal foil, preferably aluminium foil, and at least one tension reducing and/or stabilizing protective layer secured thereto for protecting the metal foil against mechanical, climatic and/or chemical actions. Thereby the use of lead with the drawbacks related thereto is avoided.

In a first embodiment of such a sandwich shaped sheet material according to the invention, the protective layer may have a composition of approximately the same character as the material disclosed in the above-mentioned British specification and comprise a non-curable adhesive paste applied to one side of the metal foil and a cover foil on this adhesive layer. In this case the tension reducing and stabilizing effect is achieved as a result of the adhesive layer and by choosing specially a suitable cover foil, the sheet material of this embodiment may also in other respects be equivalent to lead as covering material. Thus, for outdoor use the cover foil ought to be weatherproof and also be resistant to atmospheric pollutions and to sunlight as well as to high and low temperatures, and in addition, the cover foil should also have a suitable tearing strength. As an example of such foil material, mention can be made of PVF foil.

In another embodiment the reducing and stabilizing effect and the resistance to mechanical, climatic and/or chemical influences are achieved by means of a protective layer comprising at least one layer of an elastomeric material, preferably natural or synthetic rubber, secured to one side at least of the metal foil.

In this case the protective layer comprises preferably an elastomeric vulcanizable material on both sides of the metal foil, said layers being vulcanized

to each other through perforations in the foil to insure their connection with the foil.

For use as a flashing material it is often suitable to give the material the shape of a strip and in order to weigh down such a flashing strip in the same manner as in the use of lead, it may be advantageous to insert a strip or wire-shaped plumb, made for instance of lead, along one longitudinal side of the strip by bending the sandwich.

In the following the invention will be explained in more detail with reference to the drawings where Figs. 1 and 2 are large-scale views of a section of two embodiments of the sheet material according to the invention, while Figs. 3 and 4 illustrate the use of conventional sheet lead and of the sheet material according to the invention, respectively.

In the embodiment of Fig. 1, the sheet material is a sandwich having a total thickness of about 0.35 to 1.5 mm and consisting of an aluminium foil 1 about, for instance, 0.1 mm thick and a protective layer comprising a cover foil 2 having the above-stated properties as well as an intermediate adhesive layer 3 of a non-curable bituminous type. This sandwich is manufactured as a flat sheet and then corrugated, for instance between a pair of toothed rollers, to the shape shown, in the form of consecutive S-shaped waves or valleys, the greatest diameter a of which is a little greater than the width b of the corresponding slit aperture. However, the corrugated pattern is not restricted solely to the shape shown in the drawings, as, for instance, a more sharp-edged cross-sectional pattern may be chosen instead of the gently curved pattern.

Together with the corrugation, the waves are provided at the crest and at the external side of the trough with transverse stampings 4, the separation of which is appoximately the same size as the wave length, although this separation may be somewhat larger or smaller. As shown,

the stampings 4 on one side of the sheet are advantageously disposed substantially halfway between the stampings 4 on the other side of the sheet.

In the embodiment shown in Fig.2, the sandwich comprises, as in the embodiment of Fig.1, an aluminium foil 1' having a thickness of about 0.1 mm. In this case, however, use is made of a protective layer comprising layers 5 and 6 of elastomeric material, preferably natural or synthetic gummi, on both sides of the foil 1'. The elastomeric material may be, e.g., butyl rubber or the synthetic rubber available from Dupont under the registered trademark "Hypalon".

The protective layers 5 and 6 can be secured to the aluminium foil 1' by means of a suitable adhesive. When using a vulcanizable elastomeric material such as the above-mentioned materials, the risk of stratification of the sandwich as a result of prolonged use may, however, be avoided and the lifetime extended by providing the aluminium foil 1' with perforations as indicated at 7 and vulcanizing the protective layers 5 and 6 together through these perforations.

In the embodiment of Fig.2, the corrugation of the sandwich is carried out as explained above with reference to Fig.1, and the sandwich is provided with stampings 4' on both sides.

In practice the sheet material can be produced in the shape of a transversely corrugated strip. For the purpose of weighing down, a strip or thread-shaped plumb made, e.g., of lead, may be inserted along one longitudinal side, for instance by bending the strip along the dotted lines in Fig.2.

Figs. 3 and 4 illustrate, respectively, the use of conventional sheet lead 9 and a sheet material 10 according to the invention, for tightening work on a corrugated roof surface 11.

The conventional sheet lead 9 is made to follow the shape of the roof surface 11 by hammering as shown

by an arrow 12 against the crests of the waves while pressing down in the troughs, which results in substantial local thickness variations which cannot be predetermined and may cause cracks and breakages.

To the contrary, the sheet material 10 according to the invention can be made to follow the shape of the roof surface 11 by purely manual processing without hammering, so that the thickness is in all essentials the same at the crest of the waves and in the intermediate areas.

Instead of a sandwich material, the sheet material according to the invention may be made entirely of sheet metal such as lead. Also in this case the corrugation may be carried out in the same manner as for the sandwich designs described hereinbefore and by using a smaller sheet thickness, e.g. 0.5 mm, than in case of conventional sheet lead, the same good deformability properties are obtained.

P A T E N T C L A I M S

1. A deformable sheet material, especially for use in roof tightening, which material consists at least partly of sheet metal or a metal foil, c h a r a c t e r i z e d in that the sheet material is corrugated in continuous S-shaped waves with troughs, the diameter (a) of which is greater than the width (b) of the corresponding slit aperture.

2. A sheet material according to claim 1, c h a r a c t e r i z e d in that provision is made at the crest of the waves of transverse stampings (4, 4') with a mutual separation of the same order of magnitude as the wave length.

3. A sheet material according to claim 2, c h a r a c t e r i z e d in that the transverse stampings (4, 4') on one side of the sheet are disposed substantially halfway between the stampings on the other side of the sheet.

4. A sheet material according to claim 1, 2 or 3, c h a r a c t e r i z e d in that it consists of a sandwich of metal foil, preferably aluminium foil (1, 1') and at least one tension reducing and/or stabilizing protective layer secured thereto for protecting the metal foil against mechanical, climatic and/or chemical actions.

5. A sheet material according to claim 4, c h a r a c t e r i z e d in that the protective layer comprises a non-curable adhesive paste layer (3) applied to one side of the metal foil (1) and a cover foil (2) on this adhesive layer.

6. A sheet material according to claim 4, c h a r a c t e r i z e d in that the protective layer comprises at least one layer (5, 6) of an elastomeric material, preferably natural or synthetic rubber, secured to one side at least of the metal foil (1').

7. A sheet material according to claim 6, c h a r a c t e r i z e d in that the protective layer

comprises layers (5, 6) of an elastomeric vulcanizable material on both sides of the metal foil, which layers are vulcanized to each other through perforations (7) in the foil to insure their connection with the foil.

8. A sheet material according to any of the claims 4-7, where the material is designed in the shape of a strip, c h a r a c t e r i z e d in that a strip- or wire-shaped plumb, made for instance of lead, is inserted along one longitudinal side of the strip by bending the sandwich.

9. A deformable sheet material consisting at least partially of sheet metal or metal foil (1) c h a r a c t e r i z e d in that the sheet material or foil (1) is corrugated to form alternate crests and troughs each enclosing a maximum width (a) greater than the width (b) of the mouth thereof.

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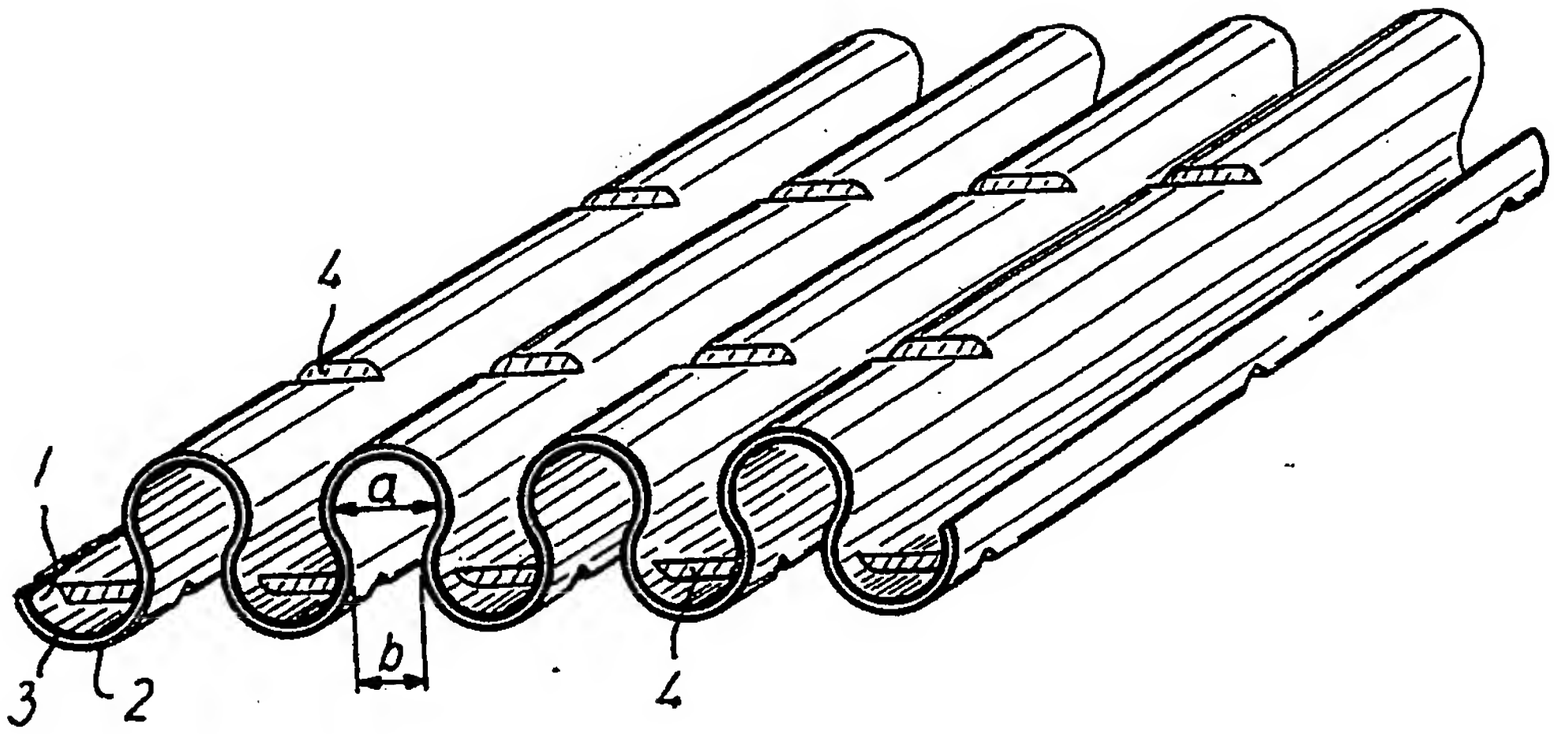

FIG. 1

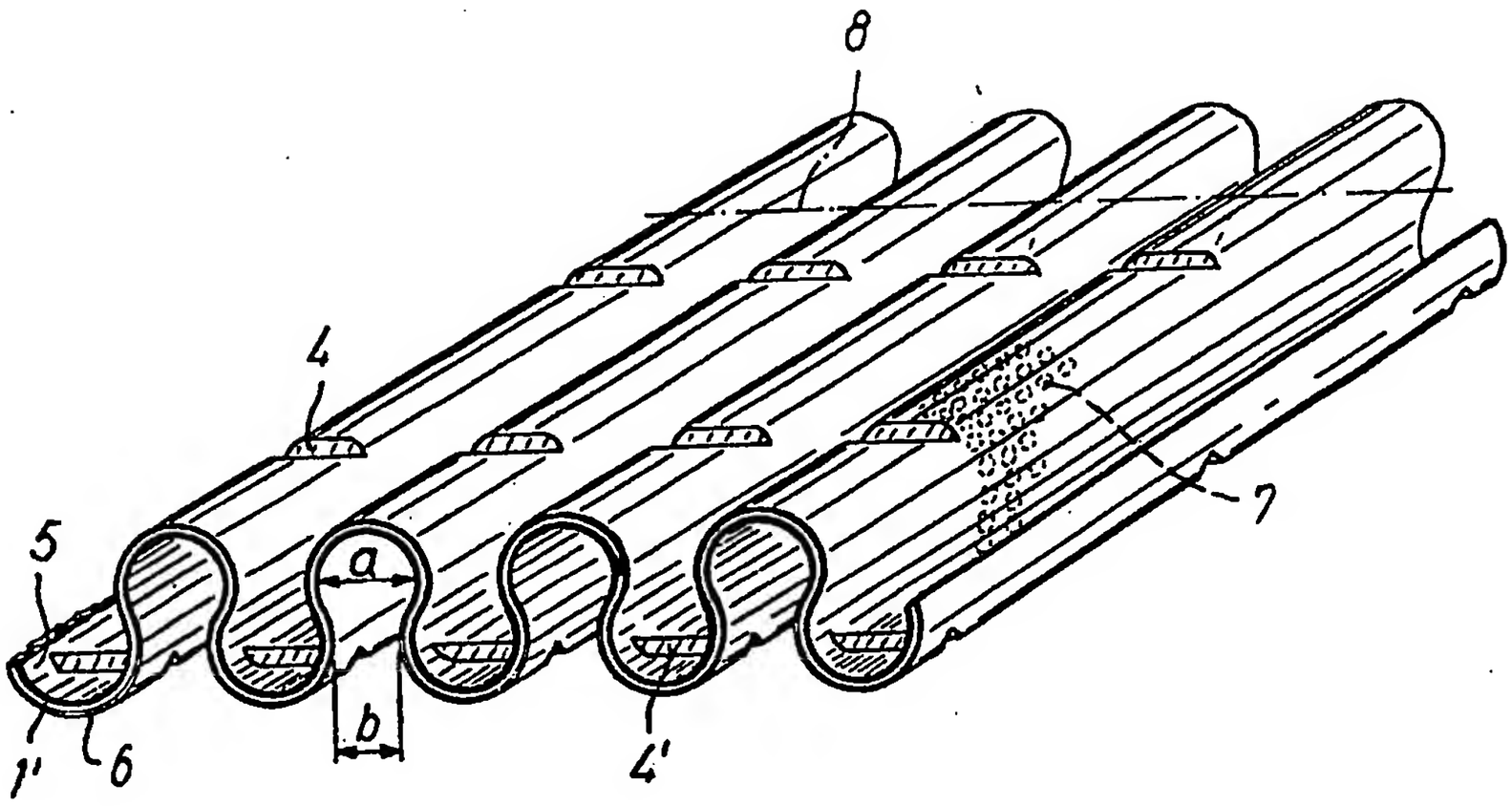

FIG. 2

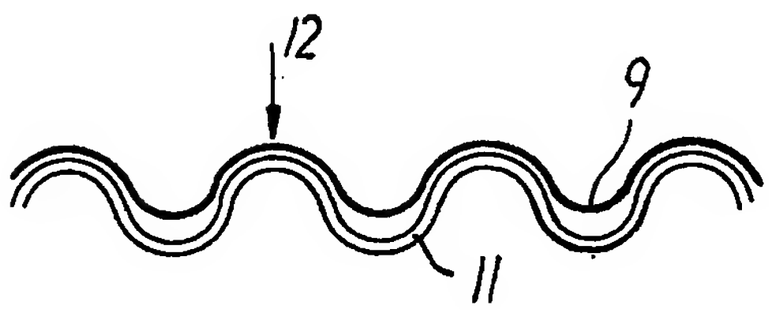

FIG. 3

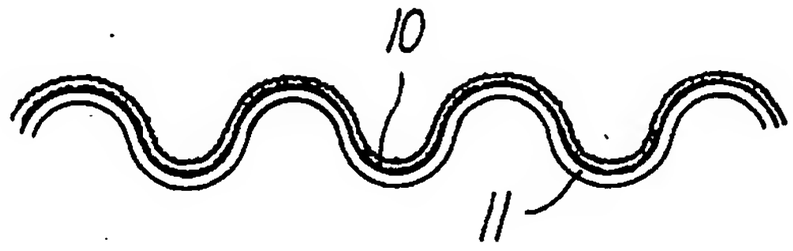

FIG. 4